

REMARKS

Claims 1, 3 to 6 and 10 to 17 as set forth in Appendix I of this paper are herewith presented for further prosecution. As indicated in the listing of the claims, Claims 20 to 24 have been canceled relative to the previous version of the claims. No new matter has been added.

REJECTION(S) UNDER 35 U.S.C. §103(A):

- a) Claims 1, 3 to 5 and 15 to 17 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable in light of the teaching of *Biglione et al.* (US 4,606,873) when taken in view of the disclosure of *Zimmermann et al.* (US 5,112,875) and further in view of the product information of *Mack et al.* (*Trends in Underwater Pelletizer Technology: Considering New Types of Polyolefin Resins*);
- b) Claim 6 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable in light of the references applied in (a) and further in view of *Carmody et al.* (US 3,673,126);
- c) Claims 10 to 14 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable in light of the references applied in (a) and further in view of *Knaus et al.* (US 5,605,937); and
- d) Claim 16 stands rejected under 35 U.S.C. §103(a) as allegedly being unpatentable in light of the teaching of *Biglione et al.* when taken in view of the disclosures of *Schippers* (US 3,410,938) and further in view of the product information of *Mack et al.*

Additional rejections of Claims 20 to 24 are rendered moot since those claims are canceled.

*“Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented.”*²⁾ The analysis under 35 U.S.C. §103 *“need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.”*³⁾ However, *“rejections on obviousness grounds cannot be sustained by*

2) *Graham v. John Deere*, 383 U.S. 1, at 17 – 18, 148 USPQ 459 (1966). Cf. *KSR Int’l v. Teleflex, Inc.*, 550 U.S. ____ (2007), Slip op. at 2.

3) *KSR Int’l v. Teleflex Inc.*, 127 S.Ct. 1727, ___, 82 USPQ2d 1385, 1397 (2007); emphasis added.

*mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.”*⁴⁾ Moreover, it is necessary “*to determine whether there was an apparent reason to combine known elements in the fashion claimed by the patent at issue.*”⁵⁾ Accordingly, obviousness cannot be established by combining the teachings of the prior art to produce a claimed invention, absent some teaching, suggestion or incentive supporting the combination.⁶⁾ It is insufficient that the prior art discloses the components of the claimed invention, either separately or used in other combinations; there must be some teaching, suggestion, or incentive to make the combination that was made by the inventor.⁷⁾

The cited references, considered as a whole for what they reasonably conveyed to one having ordinary skill in the pertinent art and viewed without the benefit of impermissible hindsight vision afforded by applicants’ invention, provide no apparent reason to combine the known elements in the fashion claimed. Although the references disclose components of applicants’ process, the elements are disclosed separately, and are used in other combinations, and neither the references nor the general technical background knowledge of one having ordinary skill provide the necessary suggestion or incentive to make the modification and/or combination of elements defined in applicants’ claims. Moreover, in due consideration of the general technical background knowledge of one having ordinary skill, the Office action cannot be deemed to provide reasoning with the rational underpinning necessary to support a conclusion of obviousness.

REGARDING REJECTIONS (A) THROUGH (C):

The Office action *inter alia* alleges “[a]t the time of invention, it would have been obvious to one of ordinary skill in the art to use the polystyrene polymer with molecular weight of about 200,000 to about 300,000 g/mol as taught by ZIMMERMANN et al. in the process of preparing expandable polystyrene polymers as taught by BIGLIONE et al. in order to produce polystyrene granules from expandable styrene polymers with high degree of expandability due to the use of low level blowing or foaming agents used to make articles like seat cushions.”⁸⁾ Additionally, while

4) *KSR Int’l v. Teleflex, Inc.*, 82 USPQ2d at 1396 (quoting *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006)).

5) *KSR Int’l v. Teleflex, Inc.*, 550 U.S. ____ (2007), Slip op. at 14.

6) *Carella v. Starlight Archery*, 804 F.2d 135, 231 USPQ 466 (Fed. Cir. 1986); *In re Laskowski*, 871 F.2d 115, 10 USPQ2d 1397 (Fed. Cir. 1989).

7) *Northern Telecom, Inc. v. Datapoint Corp.*, 908 F.2d 931, 15 USPQ2d 1321 (Fed. Cir. 1990), cert. denied 498 U.S. 920 (1990).

8) Office action page 4, lines 17 to 22.

conceding that “*BIGLIONE et al. is silent to the molecular weight of the expandable polystyrene polymer and the die plate temperature as required by claim 1[,]*”⁹⁾ the Office action relies on the disclosure of *Bremner et al.* (J. Appl. Polym. Sci. 41, 1617-1627 (1990)) for allegedly suggesting that the polystyrene employed in the illustrative process of *Biglione et al.* had an average molecular weight of around 280'000 g/mol.¹⁰⁾

Applicants respectfully urge that the disclosure of *Bremner et al.* is on its face unsuited to allow any conclusion as to the molecular weight of the polystyrene polymer which was employed in the illustrative process of *Biglione et al.*

Bremner et al. state at the outset of the last paragraph on page 1622: “Since the molecular weight distributions of all polystyrene samples are similar, it is not surprising that good correlation is seen between the logarithm of the MFI and any molecular weight average[,]” (emphasis added) and in the last paragraph on page 1626: “We believe ... that the general analytical relation between MFI and M_w or any other moment of the molecular weight distributions can be formulated and shown to have some validity for linear polymers of similar molecular polydispersity and processing history. For branched polymers, or for shear modifiable polymers, however, the situation is more complex and no general relationship will be obtained unless the rheological state of the polymer can be characterized” (emphasis added). *Bremner et al.* thus clearly conveys that the applicability of the disclosed correlation between the MFI and the molecular weight is limited to polystyrenes which have a similar molecular weight distribution, similar molecular polydispersity, and similar processing history.

Moreover, *Bremner et al.* comment in the first full paragraph on page 1622 on the correlation which is depicted in Figure 1 stating: “... it should be noted that the samples tested had similar polydispersities ... and no added processing oils.” The calculation following that paragraph of the reference makes clear that the presence or absence of processing oils in the polystyrene samples, also, has a significant impact on the correlation between the MFI and the molecular weight discussed by *Bremner et al.* In fact, as further evidenced by the enclosed copies of *Cabot's* “Melt Flow Index” paper and *Tinius Olsen's* paper “An introduction to Melt Index testing” the melt flow index of a polymer is affected by a number of factors including molecular weight distribution, the presence of co-monomers, the degree of chain branching and crystallinity,¹¹⁾ as well as fillers and

9) Office action page 4, lines 9 and 10.

10) Office action page 12, line 20, to page 13, line 10.

11) E.g., *Cabot* page 2/6 and *Tinius Olsen* page 1, second para. after Figure 1.

additives.¹²⁾ *Tinius Olsen*'s paper in particular explains that the property which is measured by melt flow tests is the melt viscosity or flow resistance of a polymer at a particular shear stress (related to the applied load) and temperature,¹³⁾ that the MFI¹⁴⁾ is (merely) an indicator (and not a measurement) of the average molecular weight,¹⁵⁾ and the MFI serves, e.g., in quality control to monitor variations in polymerization, compounding, resin degradation or improper drying.¹⁶⁾ In general, the test loads employed in the measurement of the MFI in accordance with ASTM 1238 may be 1.2, 3.8 or 5.0 kg, and the test temperature may be 190, 200 or 230°C.¹⁷⁾ Also, the size of the standard die employed in the measurement may vary.¹⁸⁾

The correlation between the MFI and the molecular weight which is discussed by *Bremner et al.* does not allow any conclusion as to the molecular weight M_w of a polystyrene sample merely on the basis of a melt index. For example, the data sheet for "Polystyrol 158 K" (of record), i.e., the polystyrene which was used in the investigations described in the application specifies a melt volume rate of 3 g/10 min. as determined with ASTM D1238 (5 kg/200°C) which, given a density of 1.05 g/cm³, corresponds to an MFI of about 3.15 g/10 min. and the respective polystyrene has an M_w of 280'000 g/mol. However, according to the Office action, *Bremner et al.* suggest that a polystyrene having a melt index of 10 "actually has a weight average molecular weight (M_w) of around 280,000 [g/mol]."¹⁹⁾ Admittedly, the MFI of applicants' sample was determined at a load of 5 kg and a temperature of 200°C whereas the investigations of *Bremner et al.* were conducted at a load of 3.8 kg and 230°C.²⁰⁾ However, *Biglione et al.* merely state that "[a] polystyrene having a melt index of 10 g/10' was fed to extruder (2) ..." and the reference is silent as to factors such as

- the conditions under which the melt index was determined, i.e., the test load and temperature;
- the presence or absence of processing aids or additives such as, e.g., stearates or mineral oils; and

12) E.g., *Cabot* pages 3/6 to 5/6.

13) *Tinius Olsen* page 1, second para. after Figure 1.

14) MFR (melt flow rate), MFI (melt flow index) and MI (melt index) are synonyms.

15) *Tinius Olsen* page 1, third para. after Figure 1.

16) *Tinius Olsen* paragraph bridging pages 1 and 2.

17) See Tables AIa and AIb on page 57 of *Shenoy et al.*

18) See *Cabot* page 2/6, first para.

19) Office action page 13, lines 3 to 6.

20) See page 1620, para. preceding "Results and Discussion" of *Bremner et al.*

- the manner in which the polystyrene was manufactured, i.e., the molecular weight distribution, the molecular polydispersity, and the processing history of the polystyrene.

As such, the disclosure of *Bremner et al.* cannot reasonably be applied to determine the molecular weight of the polystyrene polymer which was employed in the illustrative process of *Biglione et al.* In fact, the information which is given by *Biglione et al.* in and of itself is insufficient to allow a conclusion as to the actual molecular weight of the polystyrene employed in *Biglione et al.*'s illustrative example.

Applicants further respectfully urge that one having ordinary skill in the pertinent art would not have been motivated by the disclosure of *Zimmermann et al.* to employ a polystyrene having a molecular weight M_w of from 220'000 to 300'000 g/mol in the process of *Biglione et al.*

As previously urged by applicants, the discussions of the background knowledge in *Rogov et al.* (US 2008/0203597) corroborates that the melt-extrusion based process of manufacturing expandable polystyrene beads was considered in the pertinent art to be limited to particular polystyrenes and to pose stringent requirements on the polystyrene.²¹⁾ More specifically, at the pertinent time a person of ordinary skill considered an extrusion process similar to the one taught by *Biglione et al.* to require "the use of polystyrene with a molecular weight (M_w) of less than 200'000, or of 90'000 to 150'000 to be exact ..." ²²⁾ A person of ordinary skill, therefore, would not have considered the process of *Biglione et al.* to be suited to prepare an expandable styrene polymer having a molecular weight M_w of from 220'000 to 300'000 g/mol.

Zimmermann et al. teach the manufacture of expandable polystyrenes wherein the polystyrene has an average molecular weight of from about 180'000 to about 300'000 g/mol.²³⁾ However, the process does not employ melt-extrusion technology. Rather, the expandable polystyrene is prepared by way of a suspension polymerization process which is conducted in aqueous phase. Other than in a melt-extrusion based process as, for example, represented by *Biglione et al.*, the viscosity of the reaction medium in accordance with *Zimmermann et al.*'s process is determined by the aqueous phase and does not depend upon the molecular weight of the polystyrene. The disclosure of *Zimmermann et al.*, therefore, at best merely shows expandable polystyrene of high molecular weight polystyrenes, without, however, suggesting or even implying that such expandable polystyrenes may be obtainable in a melt-extrusion based process similar to the one of *Biglione et al.*

21) Cf., e.g., paras. [0006] and [0007], as well as [0011] to [0014], of US 2008/0203597. See also applicants' paper of May 20, 2009, which is herewith incorporated by reference.

22) Para. [0012] of US 2008/0203597.

23) See Office action page 4, lines 11 to 13.

The proposition that “[a]t the time of invention, it would have been obvious to one of ordinary skill in the art to use the polystyrene polymer with molecular weight of about 200,000 to about 300,000 g/mol as taught by ZIMMERMANN et al. in the process of preparing expandable polystyrene polymers as taught by BIGLIONE et al. ...”²⁴⁾ is opposed to the background knowledge evidenced by Rogov et al. and does not find support in the disclosure of Zimmermann et al. or in the disclosure of Bremner et al. upon which the Office action relied. As such, the statement is deemed to be merely conclusory and without the necessary rational underpinning.

For this reason alone, the teaching of Biglione et al. when taken in view of the disclosure of Zimmermann et al. and the product information of Mack et al. concerning underwater pelletizers cannot be deemed to render applicants’ melt-extrusion based process for the preparation of expandable styrene polymers having a molecular weight M_w of from 220’000 to 300’000 g/mol as a whole obvious within the meaning of Section 103(a). Nonetheless, the following is submitted for completeness sake:

The Office action also alleges that “[i]t would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the pelletizer of MACK et al. into the process of BIGLIONE et al. in view of BIGLIONE et al.’s suggestion to use an underwater pelletizer, and MACK et al.’s teaching of a pelletizer within the scope of those suggested by BIGLIONE et al.”²⁵⁾ asserting that “MACK et al. teach that in an underwater pelletizer, it is known to heat the die plate to a temperature which is 30 C above the temperature of the melt (which would obviously be at the wall temperature)[,]”²⁶⁾ and “that the motivation for heating the die plate of Biglione (to avoid solidification of the resin in the extrusion die) is valid and does not require any increase in the polymer temperature which would lead to premature expansion.”²⁷⁾

As previously presented by applicants, the approach to reduce the risk of solidification of the blowing agent-containing polymer melt in the extrusion die by heating the die-plate had already been investigated at the pertinent time and is documented in JP 06/031726 (of record).²⁸⁾ Seeking to eliminate the risk of solidification by heating the die-plate, the authors of the Japanese reference found, however, that “[the melt] will foam a little and will become a shape of flat and cylinder-like resin particles. Moreover, cooling of melting resin will become inadequate in the die outlet section,

24) Office action page 4, lines 17 to 20.

25) Office action page 4, line 22, to page 5, line 4.

26) Office action page 4, lines 14 to 16.

27) Office action page 14, lines 10 to 12.

28) Cf. paras. [0005] and [0006] of JP 06/031,726.

and it will foam, ...”²⁹⁾ The results which are reported in Table 1 of the Japanese reference not only confirm that heating the die-plate had a negative impact on the particle shape and caused premature foaming of the particles but also show that the particles had an undesirably increased weight. The Japanese reference, thus, corroborates that a person having ordinary skill in the pertinent art could not reasonably expect to successfully produce useful particles of expandable polystyrenes in a melt-extrusion based method when heating the die-plate.

The disclosure of *Mack et al.* is unsuited to suggest otherwise since *Mack et al.* address the extrusion of polyolefin resins which do not contain a blowing agent whereas the investigations described in *JP 06/031726* pertain to blowing agent-containing polymers. The proposition that one of ordinary skill in the pertinent art would have employed the underwater pelletizer of *Mack et al.* in the process of *Biglione et al.*, and would have heated the die-plate to avoid premature solidification of the blowing agent-containing melt,³⁰⁾ fails to duly consider the findings described in *JP 06/031726* and is, as such, contrary to the background knowledge of one having ordinary skill. The proposition, also, does not find support in the teaching of *Biglione et al.*, or in the disclosure of *Zimmermann et al.* As such, the proposition is deemed to be no more than a conclusory statement lacking the necessary rational underpinning.

The teaching of *Biglione et al.* when taken in view of the disclosure of *Zimmermann et al.* and of *Mack et al.* therefore also cannot be deemed to render a melt-extrusion based process obvious within the meaning of Section 103(a) wherein the process entails heating the die-plate to a temperature in the range of from 20 to 100°C above the temperature of the polymer melt.

The cited references, considered as a whole for what they reasonably conveyed to one having ordinary skill in the pertinent art and viewed without the benefit of impermissible hindsight vision afforded by applicants’ invention, provide no apparent reason

- to employ a polystyrene having a molecular weight M_w of from 220’000 to 300’000 g/mol in the process of *Biglione et al.*, and/or
- to heat the die-plate to a temperature in the range of from 20 to 100°C above the temperature of the blowing agent-containing polymer melt in *Biglione et al.*’s process,

i.e., to combine the known elements in the fashion claimed by applicants. To the contrary, the background knowledge documented by *Rogov et al.* and by the Japanese reference discouraged, if not taught away from, either one of the proposed modifications of the process of *Biglione et al.*

29) Para. [0006] of *JP 06/031,726*.

30) Cf. Office action page 14, lines 2 to 12.

Also, in due consideration of the general technical background knowledge of one having ordinary skill, the Office action cannot be deemed to provide reasoning with the rational underpinning that is necessary to support a conclusion of obviousness. It is therefore respectfully urged that the rejection in (a) be withdrawn. Favorable action is solicited.

The rejections in (b) and (c) rely on the combination of references addressed in the foregoing for allegedly supporting a finding of obviousness of the independent claim, i.e., Claim 1,³¹⁾ and apply

- the disclosure of *Carmody et al.* regarding Claim 6 for allegedly showing that “*it would have been obvious to one of ordinary skill in the art to use the teaching composition comprising of plasticizer additives as taught by CARMODY et al. the process as taught by modified BIGLIONE et al. in order to strongly bind, adhere and incorporate the blowing agent into the polymer melt by using plasticizers[,]*”³²⁾ and
- the disclosure of *Knaus et al.* regarding Claims 10 to 14 for allegedly showing that “*it would have been obvious to one of ordinary skill in the art to use the teachings of the die head characteristics as disclosed by KNAUS in the process as taught by BIGLIONE et al. in order to produce different marketable size and shape polystyrene granules from expandable styrene polymers with high degree of expandability due to the use of low level blowing or foaming agents ...*”³³⁾

However, if an independent claim is non-obvious under 35 U.S.C. §103, then any claim depending therefrom is non-obvious,³⁴⁾ and the foregoing remarks show that the subject matter of independent Claim 1 is not rendered unpatentable by the teaching of *Biglione et al.* when taken in view of the disclosure of *Zimmermann et al.* and of *Mack et al.* It is therefore also respectfully urged that the rejections in (b) and (c) be withdrawn. Favorable action is solicited.

REGARDING REJECTION (D):

The Office action alleges that “[i]t would have been *prima facie* obvious to one of ordinary skill in the art at the time of the invention to incorporate the pelletizer of MACK et al. into the process of BIGLIONE et al. It would have been *prima facie* obvious to one of ordinary skill

31) Office action page 7, lines 5 and 6, and page 8, lines 3 and 4.

32) Office action page 7, lines 13 to 17.

33) Office action page 8, line 21, to page 9, line 3.

34) *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

in the art at the time of the invention to incorporate the degassing of SCHIPPER [sic] into the process of BIGLIONE et al. in order to carefully control the foaming of the resin and remove water vapor and oxygen from the polymer melt.”

Notably, the rejection pertains solely to Claim 16 and does not include Claim 1 upon which Claim 16 depends and the elements of which are incorporated into Claim 16 by reference. As addressed in the foregoing, the teaching of *Biglione et al.* when taken alone or when taken together with the disclosure of *Mack et al.* is unsuited to support a finding that the subject matter of applicants' Claim 1 is unpatentable under Section 103(a). The disclosure of *Schippers et al.* pertains to a method of processing a thermoplastic polymer which is free of blowing agent and the reference was applied solely for showing a process including a degassing step. Thus, the additional reference cannot be deemed to be pertinent to the patentability of Claims 1 and the Office action concedes the issue by omitting Claim 1 in this rejection.

However, if an independent claim is non-obvious under 35 U.S.C. §103, then any claim depending therefrom is non-obvious. Accordingly, the teaching of *Biglione et al.* when taken in view of the disclosures of *Mack et al.* and of *Schippers et al.* is insufficient to support a conclusion that the subject matter of Claim 16 is unpatentable within the meaning of Section 103(a). It is respectfully requested that the rejection be withdrawn. Favorable action is solicited.

SUPPLEMENTAL DATA:

Applicants herewith enclose a Test Report setting forth supplemental data and further corroborating the beneficial properties which are conveyed to the product when the expandable styrene polymer is prepared in accordance with the provisions of applicants' claims. Entry and favorable consideration of the data is respectfully solicited. Also, a duly executed Declaration is currently being prepared and will be submitted as soon as it becomes available.